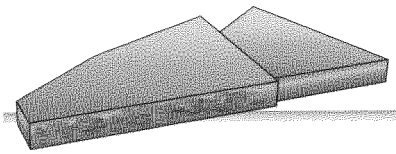

4. NATURE AND EXTENT OF CONTAMINATION

The purpose of this section is to assess available monitoring data to identify the distribution of COPCs in the RWMC environment. The emphasis in Section 4 is on the human health COPCs identified in the IRA (Becker et al. 1998), but some discussion also is provided about the occurrence of ecological COPCs that are not human health risk drivers (Hampton and Becker 2000). The discussions focus on the results from routine aquifer and vadose zone monitoring conducted by the INEEL and the USGS. The INEEL subsurface data used for this analysis were compiled from limitations and validation reports generated from laboratory analyses, with the exception of the data used for the analysis of carbon tetrachloride. Carbon tetrachloride data were assembled from several sources as cited in Section 4.8.1. The INEEL surface monitoring data (e.g., surface soil, vegetation, and runoff) were primarily obtained from the INEEL annual monitoring reports (as cited). The USGS data were obtained from the USGS.

The occurrence of each human health COPC in the following regions is discussed in subsequent sections, as indicated below and shown in Figure 4-1:

- Waste zone—contaminant inventories contained in waste at the time of disposal; waste streams that give rise to additional COPC inventories through radioactive decay and ingrowth, and waste zone nuclear logging data
- Surface—environmental monitoring data for soil, runoff water, and vegetation
- Vadose zone—environmental monitoring data for soil moisture, perched water, interbed sediments, or subsurface basalt samples
- Aquifer—environmental monitoring data for the aquifer.

Discussions are tailored to address any trends or patterns in the data. Graphs, tables, and illustrations of the patterns of COPCs in the environment are presented when data sets are large enough.

4.1 Waste Zone Data

The waste zone is generally defined by the boundaries of the disposal units (e.g., pits and trenches) within the SDA, with a vertical profile extending to the first basalt layer beneath the SDA. Waste zone data include disposal and inventory records of waste buried in the SDA and shallow nuclear logging data collected within the SDA from the Type A probe network. Data collected outside the pits and trenches are discussed in Section 4.3 as components of the vadose zone data set.

4.1.1 Inventory Data and Disposal Information

The two primary databases maintained for disposal information are CIDRA and WasteOScope. The CIDRA contains the inventory information reflected in the tables for each COPC. The database was originally based on the HDT (LMITCO 1995a) and RPDT (LMITCO 1995b) reports, which contained inventory estimates and waste characteristics developed in cooperation with the waste generators (e.g., RFP and INEEL facilities). Several corrections and updates have been incorporated into CIDRA since the HDT and RPDT reports were published. The best-estimate SDA inventories currently contained in CIDRA are presented in Table 4-1 for radionuclides and Table 4-2 for nonradionuclides.

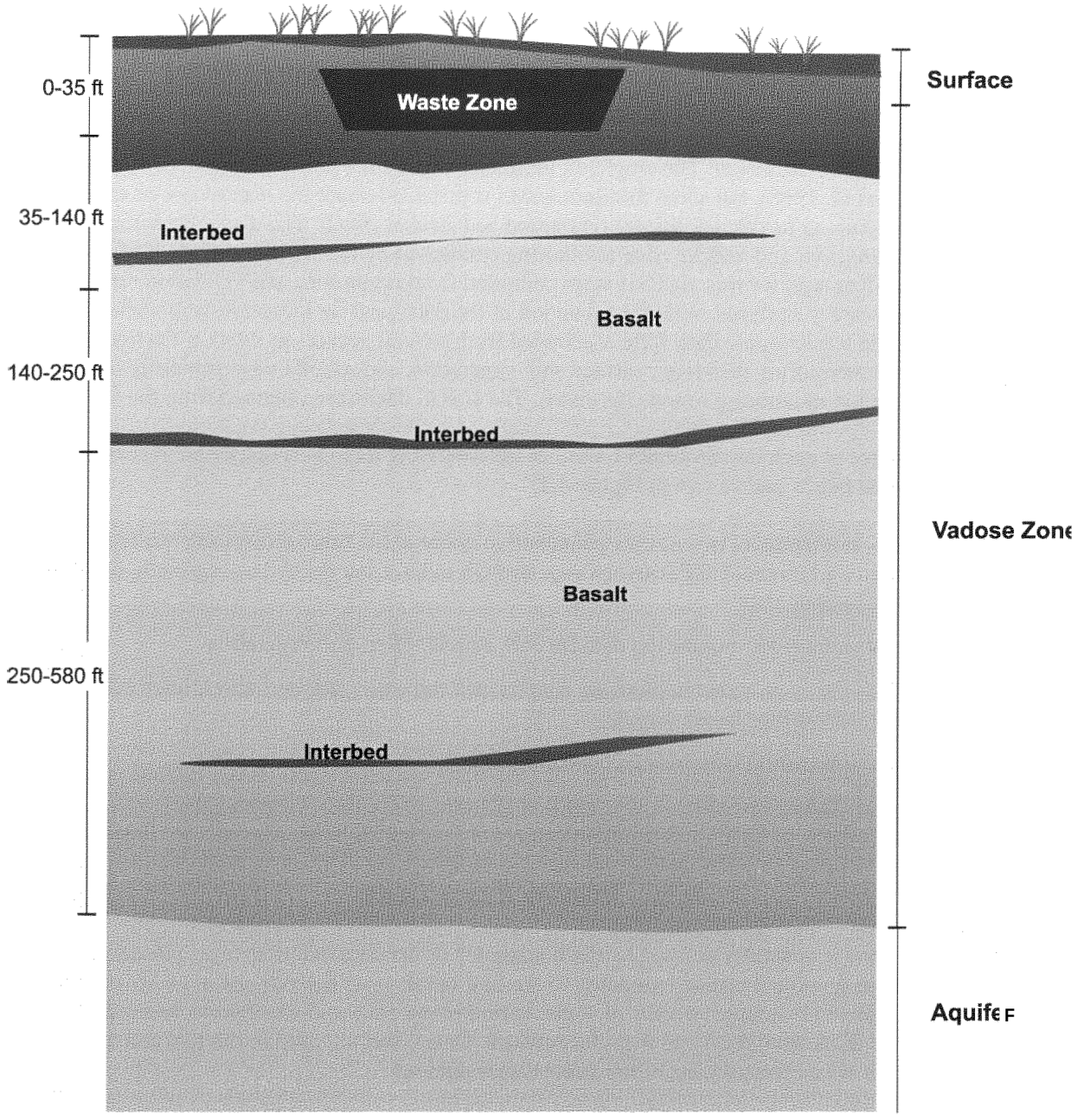

Figure 4-1. Depth intervals analyzed in the evaluation of the nature and extent of contamination for Waste Area Croup 7.

The WasteOScope database reflects the information provided on the shipping manifests, including numbers of containers, disposal location, and contact dose rate. For waste generated at the **RFP,** WasteOScope contains waste types and drum weights taken from the RFP shipping manifests and trailer load lists;.Though work continues to refine the contents of WasteOScope, the database is as complete as practicable for RFP. Continued refinements focus primarily on INEEL waste shipments to the **SDA.**

To model the release of contaminants from the waste, the inventory information within CIDRA was combined with the disposal location information in the WasteOScope database to determine where COPCs had been disposed of. The details of this process are provided in Section 3.

Table 4-1. Annual inventories (curies) of radionuclide contaminants of potential concern and associated long-lived decay chain products at the time of disposal in the Subsurface Disposal Area from 1952 to 1999.

Contaminant[a]	1952	1953	1954	1955	1956	1957	1958	1959
Ac-227	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10
Am-241[b]	1.09E+00	1.09E+00	3.64E+02	1.13E+03	2.26E+03	3.37E+03	8.23E+03	8.98E+03
Am-243[c]	3.06E-06	3.06E-06	3.06E-06	3.06E-06	2.43E-04	1.97E-04	2.52E-04	1.36E-02
C-14	5.99E+00	5.99E+00	5.99E+00	6.61E+00	6.61E+00	6.61E+00	6.61E+00	6.61E+00
Cl-36	0.00E+00	0.00E+00	0.00E+00	5.09E-08	5.09E-08	5.09E-08	5.09E-08	5.09E-08
Cs-137	7.47E+01	7.47E+01	7.47E+01	4.72E+03	4.72E+03	4.72E+03	6.08E+03	6.20E+03
I-129	1.25E-05	1.25E-05	1.25E-05	1.25E-05	4.12E-03	3.34E-03	4.04E-03	4.07E-03
Nb-94	1.32E+00	1.32E+00	1.32E+00	8.13E+00	8.13E+00	8.13E+00	8.13E+00	8.13E+00
Np-237	8.20E-04	8.20E-04	8.20E-04	8.20E-04	2.36E-02	1.92E-02	3.57E-02	3.50E-02
Pa-231	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09
Pb-210	9.88E-15	9.88E-15	9.88E-15	9.88E-15	9.88E-15	9.88E-15	9.88E-15	9.88E-15
Pu-238[d]	3.20E-01	3.20E-01	3.09E+00	1.41E+01	6.73E+01	7.21E+01	1.35E+02	1.43E+02
Pu-239	1.34E-02	1.34E-02	9.45E+01	4.72E+02	9.52E+02	1.38E+03	3.20E+03	3.51E+03
Pu-240[e]	8.67E-03	8.67E-03	2.11E+01	1.06E+02	2.13E+02	3.08E+02	7.16E+02	7.86E+02
Ra-226	7.28E-14	7.28E-14	7.28E-14	7.28E-14	7.28E-14	7.28E-14	7.28E-14	7.28E-14
Sr-90	5.12E+01	5.12E+01	5.12E+01	5.12E+01	1.90E+04	1.54E+04	1.86E+04	1.88E+04
Tc-99	4.73E-02	4.73E-02	4.73E-02	5.37E-02	2.65E+00	2.15E+00	2.59E+00	2.61E+00
Th-229	1.71E-12	1.71E-12	1.71E-12	1.71E-12	1.71E-12	1.71E-12	1.71E-12	1.71E-12
Th-230	1.43E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10
Th-232	3.32E-14	3.32E-14	3.32E-14	3.32E-14	3.32E-14	3.32E-14	3.32E-14	3.32E-14
U-233	1.37E-08	1.37E-08	1.37E-08	1.37E-08	1.37E-08	1.37E-08	1.37E-08	1.37E-08
U-234	1.02E-03	1.02E-03	2.01E+00	2.01E+00	2.03E+00	2.01E+00	2.03E+00	2.03E+00
U-235	1.61E-04	1.61E-04	1.02E-01	1.02E-01	1.34E-01	1.28E-01	1.34E-01	1.33E-01
U-236	9.22E-04	9.22E-04	5.57E-02	5.57E-02	1.45E-01	1.28E-01	1.54E-01	1.51E-01
U-238[f]	2.74E-06	2.74E-06	4.24E+00	4.24E+00	4.24E+00	4.24E+00	4.24E+00	4.24E+00

a. Green shading indicates a contaminant of potential concern identified in the Interim Risk Assessment (Becker et al. 1998); yellow shading indicates a long-lived decay chain product of a contaminant of potential concern; and blue shading indicates a long-lived parent of a contaminant of potential concern.

b. Am-241 inventories include the annual contributions from its short-lived parent, Pu-241, which total 9.74E+05 Ci.

c. Am-243 is the long-lived parent of Pu-239 and is explicitly modeled (see Section 5).

d. Pu-238 is the long-lived parent of U-234 and is explicitly modeled (see Section 5).

e. Pu-240 inventories include the annual contributions from its short-lived parent, Cm-244, which total 5.24E+04 Ci.

f. U-238 inventories include the annual contributions from its parent, Pu-242, which total 1.65E+01 Ci.

Table 4-1. (continued).

Contaminant[a]	1960	1961	1962	1963	1964	1965	1966	1967
Ac-227	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10
Am-241[b]	1.05E+04	9.74E+03	1.24E+04	1.54E+04	1.31E+04	1.87E+04	2.28E+04	8.99E+03
Am-243[c]	7.98E-02	1.34E-02	2.34E-02	1.53E-01	1.39E-02	1.34E-02	2.34E-02	1.39E-02
C-14	6.62E+00	6.78E+00	6.92E+00	6.79E+00	7.93E+00	7.84E+00	7.85E+00	7.78E+00
Cl-36	5.09E-08	1.57E-01	1.57E-01	5.09E-08	1.47E-07	1.47E-07	1.47E-07	1.47E-07
Cs-137	1.53E+04	2.63E+04	7.02E+04	2.56E+04	8.72E+03	2.77E+04	1.22E+04	8.23E+03
I-129	1.20E-04	1.20E-04	1.20E-04	1.20E-04	1.20E-04	1.20E-04	1.20E-04	1.20E-04
Nb-94	8.13E+00	8.13E+00	8.14E+00	8.13E+00	2.09E+01	2.09E+01	2.09E+01	2.09E+01
Np-237	2.34E-02	9.47E-02	3.80E-01	1.34E-01	2.65E-02	1.51E-01	4.16E-02	1.53E-02
Pa-231	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09
Pb-210	9.88E-15	9.88E-15	9.88E-15	9.88E-15	9.88E-15	9.88E-15	9.88E-15	9.88E-15
Pu-238[d]	1.52E+02	1.18E+02	2.01E+02	5.90E+02	1.58E+02	2.26E+02	3.10E+02	1.08E+02
Pu-239	4.17E+03	3.82E+03	5.20E+03	6.24E+03	5.16E+03	7.42E+03	9.08E+03	3.52E+03
Pu-240[e]	9.30E+02	8.52E+02	1.33E+03	1.57E+03	1.16E+03	1.66E+03	2.04E+03	7.87E+02
Sr-90	5.11E+02	1.15E+03	1.92E+03	1.79E+03	1.07E+03	9.40E+02	3.40E+03	3.27E+03
Tc-99	1.09E-01	1.09E-01	1.09E-01	1.09E-01	1.21E-01	1.21E-01	1.21E-01	1.21E-01
Th-229	1.71E-12	1.71E-12	1.71E-12	1.71E-12	1.71E-12	1.71E-12	1.71E-12	1.71E-12
Th-230	1.43E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10
Th-232	2.10E-03	5.49E-01	5.30E-01	2.16E-01	5.00E-10	3.32E-14	2.00E-02	3.32E-14
U-233	1.37E-08	1.37E-08	1.37E-08	1.37E-08	1.37E-08	1.37E-08	1.37E-08	5.40E-01
U-234	3.69E+00	5.28E+00	9.27E+00	2.22E+00	2.05E+00	2.26E+00	2.08E+00	2.03E+00
U-235	1.96E-01	2.78E-01	4.08E-01	1.66E-01	1.11E+00	1.15E-01	1.11E-01	1.10E-01
U-236	7.12E-02	1.15E-01	2.95E-01	1.38E-01	7.29E-02	1.50E-01	8.61E-02	6.60E-02
U-238[f]	4.70E+00	5.44E+00	5.33E+00	4.28E+00	4.26E+00	4.26E+00	4.29E+00	4.92E+00

a Green shading indicates a contaminant of potential concern identified in the Interim Risk Assessment (Becker et al. 1998); yellow shading indicates a long-lived decay chain product of a contaminant of potential concern; and blue shading indicates a long-lived parent of a wntaminant of potential concern.

b. Am-241 inventories include the annual contributions from its short-lived parent, Pu-241, which total 9.74E+05 Ci.

c. Am-243 is the long-lived parent of Pu-239 and is explicitly modeled (see Section 5).

d. Pu-238 is the long-lived parent of U-234 and is explicitly modeled (see Section 5).

e. Pu-240 inventories include the annual contributions from its short-lived parent, Cm-244, which total 5.24E+04 Ci.

f. U-238 inventories include the annual contributions from its parent, Pu-242, which total 1.65E+01 Ci.

Table 4-1. (continued).

Contaminant[a]	1968	1969	1970	1971	1972	1973	1974	1975
Ac-227	1.49E-10	1.08E-07	1.63E-07	1.49E-10	5.78E-08	1.49E-10	1.49E-10	1.49E-10
Am-241[b]	1.81E+04	1.13E+04	8.68E+03	4.85E+01	5.43E+01	4.78E+01	4.76E+01	7.15E+03
Am-243[c]	1.34E+01	1.98E-02	2.30E-02	1.34E-02	1.68E-02	1.34E-02	1.34E-02	6.64E+01
C-14	7.78E+00	2.52E+01	3.40E+01	7.78E+00	1.71E+01	5.08E+01	7.78E+00	7.78E+00
Cl-36	1.47E-07	1.22E-01	1.84E-01	1.47E-07	6.53E-02	1.47E-07	1.47E-07	1.47E-07
Cs-137	1.11E+04	4.52E+04	9.45E+03	8.84E+03	1.30E+04	8.85E+03	8.92E+03	1.10E+04
I-129	8.61E-02	1.26E-04	1.29E-04	1.20E-04	1.23E-04	1.20E-04	1.20E-04	4.28E-02
Nb-94	2.09E+01	2.09E+01	2.09E+01	2.09E+01	2.09E+01	6.79E+01	2.09E+01	2.09E+01
Np-237	4.49E-01	2.28E-01	2.28E-02	2.37E-02	5.08E-02	2.44E-02	2.37E-02	2.31E-01
Pa-231	4.08E-09	1.41E-06	2.12E-06	4.08E-09	7.54E-07	4.08E-09	4.08E-09	4.08E-09
Pb-210	9.88E-15	1.07E-10	1.62E-10	9.88E-15	5.72E-11	9.88E-15	9.88E-15	9.88E-15
Pu-238[d]	8.31E+03	1.41E+02	1.04E+02	3.83E+00	5.09E+00	3.86E+00	3.85E+00	4.11E+03
Pu-239	2.38E+03	4.41E+03	3.42E+03	2.01E+00	3.21E+00	1.27E+00	1.25E+00	4.12E+02
Pu-240[e]	1.90E+03	9.89E+02	7.65E+02	1.02E+00	1.22E+00	1.01E+00	1.10E+01	7.72E+02
Ra-226	6.25E-02	5.50E-02	3.42E-02	1.71E-03	2.50E+00	2.31E-01	1.00E+00	1.71E-03
Sr-90	9.88E+04	7.46E+03	3.29E+03	1.87E+03	1.81E+03	1.80E+03	1.95E+03	4.95E+04
Tc-99	2.79E+01	1.23E-01	1.24E-01	1.21E-01	1.22E-01	1.51E-01	1.21E-01	1.39E+01
Th-229	1.71E-12	5.01E-08	7.55E-08	1.71E-12	2.67E-08	1.71E-12	1.71E-12	1.71E-12
Th-230	1.43E-10	6.08E-09	9.09E-09	1.43E-10	3.31E-09	1.43E-10	1.43E-10	1.43E-10
Th-232	1.00E-05	5.61E-08	1.11E-04	1.09E-04	4.02E-06	3.99E-06	2.31E-05	2.58E-05
U-233	1.37E-08	1.79E-04	6.00E-01	1.37E-08	9.52E-05	1.37E-08	1.37E-08	1.37E-08
U-234	2.23E+00	7.07E+00	1.26E+00	1.42E+00	2.08E+00	7.30E-01	7.11E-01	7.11E-01
U-235	1.30E-01	2.68E-01	3.51E-01	8.00E-02	1.83E-01	5.41E-02	5.34E-02	5.64E-02
U-236	2.33E-01	1.97E-01	4.97E-02	5.46E-02	6.97E-02	1.74E-02	1.69E-02	9.45E-02
U-238[f]	5.43E+00	4.36E+00	2.64E+00	4.14E+00	6.40E+00	3.60E+00	3.61E+00	4.01E+00

a. Green shading indicates a contaminant of potential concern identified in the Interim Risk Assessment (Becker et al. 1998); yellow shading indicates a long-lived decay chain product of a contaminant of potential concern; and blue shading indicates a long-lived parent of a contaminant of potential concern.

b. Am-241 inventories include the annual contributions from its short-lived parent, Pu-241, which total 9.74E+05 Ci.

c. Am-243 is the long-lived parent of Pu-239 and is explicitly modeled (see Section 5).

d. Pu-238 is the long-lived parent of U-234 and is explicitly modeled (see Section 5).

e. Pu-240 inventories include the annual contributions from its short-lived parent, Cm-244, which total 5.24E+04 Ci.

f. U-238 inventories include the annual contributions from its parent, Pu-242, which total 1.65E+01 Ci.

Table 4-1. (continued).

Contaminant[a]	1976	1977	1978	1979	1980	1981	1982	1983
Ac-227	1.49E-10	4.11E-08	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10
Am-241[b]	1.38E+03	8.72E+01	3.91E+01	3.91E+01	3.91E+01	1.67E+01	1.60E+01	2.96E-02
Am-243[c]	5.42E+01	3.15E-03	1.25E-05	1.25E-05	1.48E-05	1.48E-05	1.48E-05	1.48E-05
C-14	1.22E+01	3.26E+01	1.22E+01	1.22E+01	1.22E+01	9.52E+00	9.52E+00	9.35E+00
Cl-36	2.27E-07	1.40E-01	2.27E-07	2.27E-07	2.27E-07	1.36E-07	1.36E-07	1.36E-07
Cs-137	2.98E+04	7.37E+04	3.15E+04	3.13E+04	3.11E+04	2.72E+04	2.65E+04	2.54E+04
I-129	5.31E-03	9.65E-05	8.83E-05	8.83E-05	8.83E-05	8.83E-05	8.83E-05	8.83E-05
Nb-94	3.17E+01	3.17E+01	3.17E+01	3.17E+01	3.17E+01	1.97E+01	1.97E+01	2.15E+01
Np-237	1.89E-01	2.98E-01	2.38E-02	2.35E-02	2.37E-02	1.42E-02	1.04E-02	1.15E-03
Pa-231	4.08E-09	5.82E-07	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09
Pb-210	9.88E-15	5.12E-11	9.88E-15	9.88E-15	9.88E-15	9.88E-15	9.88E-15	9.88E-15
Pu-238[d]	2.08E+03	1.49E+01	3.41E+00	3.40E+00	3.40E+00	2.43E+00	2.25E+00	1.61E+00
Pu-239	5.55E+01	1.21E+01	7.00E-01	5.89E-01	6.32E-01	4.62E-01	2.90E-01	1.26E-01
Pu-240[e]	1.66E+02	1.54E+00	2.87E-01	2.54E-01	3.13E-01	1.82E-01	1.65E-01	6.47E-02
Ra-226	1.71E-03	1.71E-03	4.58E-03	4.58E-03	2.53E-01	2.53E-01	2.51E-01	2.51E-01
Sr-90	1.66E+05	3.18E+04	3.17E+04	3.18E+04	3.19E+04	3.15E+04	3.13E+04	3.13E+04
Tc-99	3.26E+00	1.23E-01	1.20E-01	1.20E-01	1.20E-01	1.09E-01	1.09E-01	1.09E-01
Th-229	1.71E-12	1.94E-08	1.71E-12	1.71E-12	1.71E-12	1.71E-12	1.71E-12	1.71E-12
Th-230	1.43E-10	2.59E-09	2.98E-03	2.98E-03	2.98E-03	2.98E-03	2.98E-03	2.98E-03
Th-232	3.99E-06	4.17E-06	6.07E-05	2.37E-04	1.35E-04	1.35E-04	1.35E-04	1.35E-04
U-233	9.47E-03	7.38E-05	1.37E-08	1.37E-08	1.05E-05	1.05E-05	1.05E-05	1.05E-05
U-234	1.07E+00	1.35E+00	9.07E-01	2.32E-01	2.04E-01	1.56E-01	1.50E-01	1.35E-01
U-235	4.61E-01	7.17E-02	6.19E-02	1.56E-02	2.52E-02	2.33E-02	2.32E-02	2.28E-02
U-236	1.03E-01	1.86E-01	1.80E-02	1.78E-02	1.78E-02	1.04E-02	8.05E-03	2.02E-03
U-238[f]	4.05E+00	4.15E+00	4.07E+00	5.22E-01	4.41E-01	4.41E-01	4.40E-01	4.40E-01

a. *Green* shading indicates a contaminant of potential concern identified in the Interim Risk Assessment (Becker et al. 1998); yellow shading indicates a long-lived decay chain product of a contaminant of potential *concern;* and blue shading indicates a long-lived parent of a contaminant of potential concern.

b. Am-241 inventories include the annual contributions from its short-lived parent, Pu-241, which total 9.74E+05 Ci.

c. Am-243 is the long-lived parent of Pu-239 and is explicitly modeled (see Section 5).

d. Pu-238 is the long-lived parent of U-234 and is explicitly modeled (see Section 5).

e. Pu-240 inventories include the annual contributions from its short-lived parent. Cm-244, which total 5.24E+04 Ci.

f. U-238 inventories include the annual contributions from its parent, Pu-242, which total 1.65E+01 Ci.

Table 4-1. (continued).

Contaminant[a]	1984	1985	1986	1987	1988	1989	1990	1991
Ac-227	1.49E-10	1.49E-10	7.09E-08	6.45E-08	1.49E-10	1.49E-10	1.49E-10	1.49E-10
Am-241[b]	1.91E-01	1.34E-01	1.14E+00	1.64E+00	7.96E-02	7.79E-02	4.10E-02	3.12E+00
Am-243[c]	1.25E-05	1.23E-05	1.48E-02	1.35E-02	1.23E-05	1.23E-05	1.23E-05	1.23E-05
C-14	4.89E+00	4.89E+00	1.92E+01	4.89E+00	4.89E+00	1.36E+01	1.36E+01	1.36E+01
Cl-36	1.67E-07	1.67E-07	9.60E-02	1.67E-07	1.67E-07	4.41E-07	4.41E-07	4.41E-07
Cs-137	1.59E+02	3.12E+02	1.77E+02	7.34E+02	4.02E+01	5.88E+01	1.31E+03	8.03E+01
I-129	8.90E-05	8.90E-05	9.43E-05	8.90E-05	8.90E-05	8.90E-05	3.58E-04	8.90E-05
Nb-94	2.26E+01	2.26E+01	2.26E+01	2.26E+01	2.26E+01	5.92E+01	5.92E+01	5.92E+01
Np-237	1.01E-03	9.83E-04	9.38E-04	4.43E-03	9.19E-04	9.15E-04	9.14E-04	9.13E-04
Pa-231	4.08E-09	4.08E-09	6.70E-07	6.10E-07	4.08E-09	4.08E-09	4.08E-09	4.08E-09
Pb-210	9.88E-15	9.88E-15	2.30E-10	2.10E-10	9.88E-15	9.88E-15	9.88E-15	9.88E-15
Pu-238[d]	1.65E+00	1.62E+00	2.08E+00	2.19E+00	1.62E+00	1.58E+00	1.58E+00	1.58E+00
Pu-239	3.01E-01	3.01E-01	3.45E-01	4.86E-01	2.89E-01	1.70E-01	1.63E-01	1.62E-01
Pu-240[e]	1.43E-02	1.40E-02	6.12E-02	7.25E-02	8.49E-03	4.46E-03	4.57E-03	4.43E-03
Ra-226	2.20E-01	2.20E-01	2.20E-01	2.20E-01	2.20E-01	7.28E-14	7.28E-14	7.28E-14
Sr-90	4.41E+02	4.03E+02	4.03E+02	4.94E+02	4.01E+02	4.18E+02	4.31E+02	3.99E+02
Tc-99	1.65E-01	1.65E-01	1.67E-01	1.65E-01	1.65E-01	2.00E-01	2.03E-01	2.00E-01
Th-229	1.71E-12	1.71E-12	5.08E-08	4.62E-08	1.71E-12	1.71E-12	1.71E-12	1.71E-12
Th-230	1.43E-10	1.43E-10	5.14E-09	4.69E-09	1.43E-10	1.43E-10	1.43E-10	1.43E-10
Th-232	3.32E-14	3.32E-14	2.09E-08	1.91E-08	3.32E-14	3.32E-14	3.32E-14	3.32E-14
U-233	1.37E-08	1.37E-08	8.52E-05	7.75E-05	1.37E-08	1.37E-08	1.37E-08	1.37E-08
U-234	3.96E-01	3.96E-01	3.98E-01	4.24E-01	5.16E-01	3.13E-01	2.54E-01	3.24E-01
U-235	2.29E-02	1.71E-02	1.72E-02	1.84E-02	2.26E-02	1.38E-02	1.14E-02	1.43E-02
U-236	2.07E-03	2.03E-03	2.00E-03	4.15E-03	1.99E-03	1.98E-03	1.98E-03	1.98E-03
U-238[f]	8.22E-02	7.79E-02	8.28E-02	1.56E-01	4.98E-01	2.62E-01	5.32E-02	3.00E-01

a. Green shading indicates a contaminant of potential concern identified in the Interim Risk Assessment (Becker et al. 1998); yellow shading indicates a long-lived decay chain product of a contaminant of potential concern; and blue shading indicates a long-lived parent of a contaminant of potential concern.

b. Am-241 inventories include the annual contributions from its short-lived parent, Pu-241, which total 9.74E+05 Ci.

c. Am-243 is the long-lived parent of Pu-239 and is explicitly modeled (see Section 5).

d. Pu-238 is the long-lived parent of U-234 and is explicitly modeled (see Section 5).

e. Pu-240 inventories include the annual contributions from its short-lived parent, Cm-244, which total 5.24E+04 Ci.

f. U-238 inventories include the annual contributions from its parent, Pu-242, which total 1.65E+01 Ci.

Table 4-1. (continued).

Contaminant[a]	1992	1993	1994	1995	1996	1997	1998	1999	Total
Ac-227	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10	1.49E-10	5.12E-07
Am-241[b]	2.95E-02	3.71E-02	1.20E+00	1.24E-01	3.04E-02	3.48E-01	2.88E-01	1.09E-01	1.83E+05
Am-243[c]	1.23E-05	1.23E-05	3.06E-06	4.50E-06	3.33E-06	4.91E-06	3.09E-06	6.23E-06	1.34E+02
C-14	1.36E+01	1.36E+01	8.62E+00	1.47E+00	1.60E+00	1.46E+00	1.59E+00	1.47E+00	5.00E+02
Cl-36	4.41E-07	4.41E-07	8.37E-02	3.22E-02	2.78E-02	2.39E-02	1.16E-02	4.95E-03	1.11E+00
Cs-137	1.97E+02	1.75E+01	5.39E+00	1.40E+01	8.06E+00	8.82E+00	1.59E+01	2.28E+01	6.17E+05
I-129	8.90E-05	8.90E-05	1.57E-03	4.57E-05	2.65E-05	9.34E-04	2.06E-03	4.21E-05	1.58E-01
Nb-94	5.92E+01	5.92E+01	3.86E-01	1.13E-01	1.98E-01	1.30E-01	2.75E-02	3.79E-04	1.00E+03
Np-237	9.13E-04	9.13E-04	8.41E-03	7.70E-04	2.06E-04	2.79E-04	6.06E-04	2.47E-04	2.64E+00
Pa-231	4.08E-09	4.08E-09	6.77E-09	4.18E-09	4.21E-09	7.75E-09	7.32E-08	8.58E-04	8.64E-04
Pb-210	9.88E-15	9.88E-15	9.88E-15	9.88E-15	9.88E-15	2.73E-08	4.81E-07	1.05E-09	5.10E-07
Pu-238[d]	1.58E+00	1.58E+00	3.26E-01	2.93E-01	2.87E-01	3.33E-01	2.97E-01	2.99E-01	1.71E+04
Pu-239	1.62E-01	1.62E-01	2.02E-02	3.13E-02	5.33E-03	5.12E-02	5.03E-02	3.20E-02	6.49E+04
Pu-240[e]	4.43E-03	4.43E-03	8.50E-03	5.96E-03	2.78E-03	5.13E-02	2.37E-02	1.98E-02	1.71E+04
Ra-226	7.28E-14	7.28E-14	7.28E-14	7.28E-14	1.20E-03	3.95E-03	5.57E-02	1.83E-02	6.00E+01
Sr-90	5.04E+02	3.89E+02	4.15E+00	6.43E+00	8.58E+00	1.09E+01	1.79E+01	1.04E+01	6.44E+05
Tc-99	2.00E-01	2.00E-01	7.10E-03	2.29E-01	8.00E-03	3.98E-02	4.78E-01	1.34E-01	6.05E+01
Th-229	1.71E-12	1.71E-12	6.17E-11	1.71E-12	3.93E-06	8.38E-08	2.52E-06	9.94E-09	6.81E-06
Th-230	1.43E-10	1.43E-10	5.66E-07	1.33E-05	7.57E-06	2.47E-03	1.08E-02	9.21E-05	3.13E-02
Th-232	3.32E-14	3.32E-14	1.70E-05	9.43E-03	2.42E-04	1.42E-02	1.85E-03	8.00E-05	1.34E+00
U-233	1.37E-08	1.37E-08	2.59E-01	6.81E-02	4.50E-04	1.19E-03	2.05E-02	7.24E-03	1.51E+00
U-234	2.55E-01	2.54E-01	4.39E-01	1.04E-01	3.96E-04	1.83E+00	5.26E-02	6.74E-02	6.74E+01
U-235	1.11E-02	1.11E-02	2.92E-02	7.22E-03	4.20E-04	4.70E-02	1.86E-01	5.89E-03	5.54E+00
U-236	1.98E-03	1.98E-03	3.85E-02	1.04E-02	9.31E-04	5.57E-04	3.20E-03	5.17E-03	2.86E+00
U-238[f]	5.54E-02	5.43E-02	2.00E+00	5.41E-01	6.93E-04	8.00E-01	3.00E-01	2.56E-01	1.17E+02

a. Green shading indicates a **contaminant** of potential concern (COPC) identified in the **Interim Risk** Assessment (Becker **et** al. 1998); yellow shading indicates a long-lived decay chain product of a COPC: and blue shading indicates a long-lived **parent** of a **COPC**.

b. Am-241 inventories include the **annual** contributions from its short-lived parent. Pu-241, which **total** 9.74E+05 Ci.

c. **Am-243** is the long-lived parent of **Pu-239** and is explicitly **modeled** (see Section 5).

d. Pu-238 is the long-lived parent of **U-234** and is explicitly **modeled** (see Section 5).

e. Pu-240 inventories include the **annual** contributions from its short-lived parent. Cm-244. which **total** 5.24E+04 Ci.

f. **U-238** inventories include **the annual** contributions from its parent. **Pu-242,** which **total** 1.65E+01 Ci.